tematic matters is rather less detailed than in the English "Zoological Record," the notices of anatomical and physiological papers are fuller, and the student will always find indications of the direction in which to look for information on other subjects. The conductors of these useful Reports have always been in the habit of delaying their publication until the literature of each year could be analysed as completely as possible, and in the present issue we have only the particulars of the contributions to entomological knowledge published during the years 1867-68. The Insecta proper are reported upon by M. F. Brauer of Vienna, whilst Prof. Gerstäcker confines his labours to the Myriopoda, Arachnida, and Crustacea.

W. S. D.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his Correspondents. No notice is taken of anonymous communications.*]

The Science and Art Department

BELIEVING your columns to be at all times open for the discussion of matters connected with Science and Art teaching, I venture to offer a few remarks on the administration of the above-named Department.

Since the arrival of the results of the last May examination, the teachers have been enabled to make up their claims for payment, and there has been a great outcry from all parts of the country on account of the serious reduction that has taken place in the amounts the teachers are entitled to claim for their work. This reduction arises from the operation of the last alteration by the Department of the scale of payments on results, the full effect of which was not felt until this year.

Many objections were raised at the time the minute was issued (in the latter part of 1869), especially to its being introduced after the commencement of the work of the session, and in deference to these remonstrances it was modified in its application to the May examinations of 1870, and its full operation deferred till the May just past. When I say just past I am speaking after the manner of the Department, for they are so far behind that the Annual Report for the Session of 1869-70 has not yet been received by the committees here.

Now I venture to submit that this reduction in the scale of payments is likely to have a very injurious effect on the spread of education in Science. In many cases, especially in small towns, and where a teacher has a class in only one or two subjects, the amount of payment to be received is so small as to give rise to the apprehension that such classes will be given up, because of the utter inadequacy of the payment to remunerate a teacher for the time and trouble spent in the work of instructing them. To give an illustration, I have just been informed of an instance where a teacher has had to proceed fourteen miles by rail to give his lectures to a class, and the result of the recent examination is that he received absolutely nothing from the Department in respect of this class, all those of the students who passed being persons of the middle classes.

When in conjunction with such facts as these we read that the payment for instruction in Science and Art in 1870 was 17,000*l.* less than in the previous year, there seems great reason for the complaints of the teachers, and one must, I think, come to the conclusion that the Department has proceeded too far in the direction of economy to be conducive to efficiency or to the continued spread of scientific instruction.

If the present scale is to be retained, I think the suggestion of a writer in the *Daily News* recently, that the system of payment by results alone should be modified, is worthy of consideration. The teacher often has the greatest amount of trouble with those students who just miss obtaining a certificate, and in these cases the master receives nothing at all for the labours of the session. It would be more encouraging to the teacher if a small payment was made for those students who have attended the required number of class lectures, although they may not be able to pass the examination for proficiency. Of course, there should be safeguards provided against the abuse of such a rule, say, by excluding from its operation all such as are unable to attempt a stated proportion of the questions propounded.

Even under the present arrangements I have seen many students sit idle the greater part of the evening, or leave the examination room as soon as permitted to do so by the regulations, through not being able to attempt to answer more than two or three questions.

With regard to another matter of which complaint has been made, viz., the recent minute of the Department imposing fines on Committees who ask for a larger number of papers than they require, I must say I cannot see the reasonableness of the complaint. At the last May examination in Plymouth, one school alone (according to the printed list issued by the department) sent up a requisition for 714 papers in the various subjects of Art and Science, while the total number of papers worked by pupils of that school, and by strangers whose papers were asked for through its committee, was only 339—less than half. If this case is at all a sample of what was occurring in the country generally, and the issue of the minute leads me to think such must have been the case, I consider it was quite time for something to be done to prevent such wholesale waste. Of course in all schools there will be a certain number who will shrink back at the last moment, after having given in their names for the examination, and this being fairly provided for, I do not see anything in this regulation that efficient schools and committees should complain of.

A LOCAL COMMITTEEMAN

Plymouth, Sept. 14

Elementary Geometry

I HAVE to thank the Editor of NATURE for inserting my letter, and Mr. Wilson for writing so fully. I was not aware when I wrote, that Mr. Wilson had himself published an elementary book on geometry. He has modestly omitted to refer to it; but I have seen it, and it appears to me a suggestive book for a teacher. He acknowledges himself unable to recommend one suited to boys, for laying the foundation of geometry.

Mr. Wilson's advice seems rather suited to teachers of geometrical drawing than of mathematics. Of course it is essential that a boy should know what measuring means; but scales of measurement have no essential connection with geometry. Nevertheless, I entirely agree with him that much trouble must be taken to teach the metrical system, especially as it is not likely to be popularly used in England, at least while our children are living. To purchase a simple metrical rule is by no means an easy task. They are not kept, that I can find, at any *ordinary* instrument makers in London, Oxford, or Cambridge.

With your permission I will say what I think is required in a book for boys. It must, to a certain extent, be suitable for being committed to memory, as Euclid is. No child is capable of taking in a subject, especially if it involves logical thought, except by very slow degrees; and must at the beginning commit much to memory which he does not comprehend. What I write will appear, to those who do not know children, to involve a most vicious principle in teaching; but it is, nevertheless, a fact. Our new book must, therefore, contain all the steps of every proof in full, and no symbols must be used. In the next place, it must not be artificial. It seems agreed that the use of compasses ought to be of the nature of a postulate, which would at once get rid of such propositions as the second and third of Euclid. There can be no reason for excluding the idea of the motion of a point, since in practice no figures can be drawn except by moving the pencil's point. It appears then that, having once got over the difficulty of defining a point, a line should be "the path of a point," a definition which would easily lead on to the doctrines of curvature and tangents; and a straight line would be that which does not alter its direction (virtually Euclid's definition); and, as in Mr. Wilson's book, parallel straight lines, those whose directions are the same.

It seems to me that it would be better to retain Euclid's definition of proportion, only converting it into a *test* of proportion; because the constructions founded upon it are so convenient for geometrical purposes; and if it be superseded by the algebraical mode of treating the subject, reasoning on in commensurable quantities must be introduced.

In fine, the book which is to supplant Euclid appears to be at present a desideratum. When it appears, it probably must be the work of more heads than one, if it is to be generally accepted among teachers.

A FATHER

THE circumstances attending my own introduction to geometry lead me to doubt whether a long course of practical geometry is

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the best beginning. I believe that, on the contrary, unless the demonstrative and deductive principles of the science are soon introduced to the student's notice, he is likely to acquire a distaste for the subject.

I was learning, under an infliction of practical geometry (at school), to detest the very sight of a box of mathematical instruments, when a fortunate illness kept me at home for two or three years. I believe that Euclid, as it would have been introduced to me at school, would have rendered my dislike for mathematics complete. But becoming possessed of a Simson's "Euclid," and *reading* it instead of learning it for "class," I found geometry the most enjoyable of subjects. In a very few months I came to the end of the book, and I have never lost the liking for geometry which I had by that time acquired.

Let it not be supposed, however, that I advocate the claims of Euclid as a text-book. The first, third, and sixth books might indeed be retained—with certain omissions and modifications; but the second and fourth books (setting aside a few propositions) are monstrosities of clumsiness.* The fifth, eleventh, and twelfth could never be generally used in their present form. But whether a totally new text-book be adopted or Euclid be modified, I am convinced that until the demonstrative and deductive nature of the science is recognised the interest of the student will not be excited.

While, however, my own experience will not permit me to believe that a course of practical constructions is a suitable introduction to geometry, I certainly agree with Mr. Wilson in regarding careful constructions as of the utmost importance to the learner. But, in my judgment, the processes of construction should accompany, not precede, the study of some demonstrative and deductive treatise.

I believe the chief difficulty under which we labour at present, resides in the fact that, owing to the small encouragement given to the study of geometry at our Universities, we have, even among our ablest mathematicians, very few able geometricians. One cannot read the Cambridge text-books of mathematics—written though these are, in many instances, with singular ability—without becoming convinced of this. So soon as a geometrical construction is introduced we recognise the clearest traces of inaptitude. The fact is s ill more clearly evidenced in treatises professedly geometrical. I take up an edition of Euclid, prepared by a very eminent mathematician, a senior wrangler, and, opening at random the portion relating to deductions, I find the following problem:—"Required to draw a circle through a given point to touch two intersecting lines;" and to solve this obvious third-book problem the aid of the sixth book is called in.

But it is hardly to be wondered at that university mathematicians are, as a rule, not strong in geometry, for the study of geometry is very little encouraged by university tutors. Indeed, an aptitude for geometrical methods is generally regarded as more mischievous than useful in the Tripos. I can remember the hints I myself received on this point. A few instances may perhaps interest your readers.

The first hint was given me in the lecture-room by a high wrangler (an excellent geometrician). The following proposition had been submitted—"A ball is placed on a horizontal plane, above which is a luminous point; show that the length of the minor axis of the ball's elliptic shadow depends only on the height of the luminous point above the plane." I wrote for answer that the fact is obvious, because two sloping planes touching the ball, and with a horizontal intersection through the luminous point, must clearly have the same slope wherever the ball is placed. The proof was accepted, and even regarded (to my infinite surprise) as ingenious; but I was warned not to leave the safe track of analysis.

The next hint was given me by my private tutor, a senior wrangler with fine (but untrained) geometrical powers, on the score of my solving geometrically some problems relating to epicycloidal and hypercycloidal areas.

The third hint was given me by a vacation tutor, also a senior wrangler, and was perhaps the best deserved of the three. He had set me a problem relating to a curve which chanced to be a projection of the four-pointed hypercycloid, and the problem was meant as an exercise in analytical processes. Knowing very little about these, I ventured to proceed *more meo*. I first projected the curve back again (so to speak), established the property in the case of the quadricuspid hypercycloid, and rejected all my constructions on the original plane of the curve. I shall never forget the solemnity of the warning I received.

The last case I shall refer to relates to a probability problem (the last in Todhunter's "Integral Calculus") about a messenger and a shower of rain, the messenger's "expectation" under certain stated conditions being expressed in the following pleasing form:—

$$\frac{v}{n}\left\{\frac{1}{2}-\frac{u}{v}+\frac{u(u+v)}{v^2}\log\frac{u+v}{u}\right\}$$

From the day that I gave a geometrical solution of this problem (the logarithm coming out as a hyperbolic area) I was given up as a bad job. No wonder, indeed, for as a problem in the Integral Calculus it can be solved in half-a-dozen lines.

So little encouragement is given to geometrical work, that I know instances where men who have taken very high degrees could not solve the easiest geometrical problems. Many indeed in my time (I believe Mr. Wilson would confirm this) in their second or third year at Cambridge, scarcely know what has to be done with such problems—that is, even how to try to solve them. I wrote a little pamphlet four or five years ago, to show how such problems should be attacked, proceeding on the following plan:—I took the case of a beginner dealing with easy geometrical problems, and considered his difficulties and false steps, as well as the true demonstration ultimately evolved. I did this because I had found it the only effectual course with pupils. To give problems, and on the pupil failing to solve them, to show him the solution, is utterly useless. One must listen to his reasoning, wrong or right, to the purpose or not—show him why it is wrong, or not effective towards the solution of the problem; and so gradually guide him towards the correct solution. In the pamphlet I employed a corresponding method.

Unfortunately (for me at any rate) Messrs. Longmans submitted this pamphlet to "a competent mathematician," who immediately misunderstood my plan; took the imagined difficulties for real difficulties of my own, and solved for my behoof an immensely difficult problem—the first worked-out example in Potts's Euclid. This achievement (*par parenthèse* my pamphlet also) was then submitted to another competent mathematician, and he, excited to emulation, suggested another solution of a problem which a boy of twelve might safely attack. Finally, these labours were submitted to Messrs. Longmans and (signatures removed) to myself. So my pamphlet has remained in my desk; for I thought better of it than to send it begging.

We want geometricians more than text-books just now. If our universities would give geometry a reasonable position among the subjects for mathematical examination, we should probably soon have both. At present a man with geometrical tastes must either turn from his favourite subject during his university career (with small chance, perhaps, of resuming it) or must be content with but a small share of university success.

Brighton, September 15 [R. A. PROCTOR

* All the propositions of Book II, save four, may be established (usually) in three lines from the first two, of which they are in fact little more than corollaries. The main objection to the fourth book relates to the inscription and circumscription of the regular figures; but throughout the book the heaviness of Euclid's method is much felt.

Captain Sladen's Expedition

IN reply to F.R.S.'s inquiry in your issue of September 14, I may state that the last number of the "Proceedings of the Zoological Society of London" (1871, part 1) contains several articles by Dr. John Anderson relating to discoveries made during Capt. Sladen's expedition to Yunan, and that the next number (1871, part 2), which I am now preparing for the press, will contain others.

It was Dr. *Thomas* Anderson, Curator of the Botanic Garden at Calcutta, whose untimely death we have recently to lament. Dr. *John* Anderson (his brother) is, I am happy to say, in good health at his official post as Curator of the Indian Museum and Professor of Comparative Anatomy at Calcutta, or was so, at all events, at the date of his last letters to me, about a month since.

11, Hanover Square, Sept 16 P. L. SCLATER

Deschanel's Physics

As regards the particular passage in my edition of Deschanel which I am challenged to defend by your Reviewer (NATURE, vol. iii. p. 343), his charge, which is somewhat obscured by rhetorical embellishment, seems to be that in the factor $\frac{H-h}{760}$ it has not been indicated that H and h, as well as 760, denote so many millimetres of mercury *at zero*. I think this was scarcely necessary, as the question whether the observed or reduced heights of the mercurial columns should be employed, is not one on which

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